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(54) Method of printing

(57) A method of printing using a thermal print head (11) comprises a plurality of printing elements (12) arranged generally in an array each of which may selectively be energised and de-energised under the control of a control means (30) to transfer pixels of marking medium from a carrier (14) onto a substrate (15) or to activate pixels on a sensitive substrate, the method comprising providing to the control means (30) data dependent on the nature of the image to be printed which would enable the image having an image length L to be printed as a matrix of pixels at a linear resolution of C where C is the number of image columns per unit length in the direction of printing, characterised in that the method includes causing relative movement between the print head (11) and the substrate (15) such that the print head (11) relatively traverses the substrate (15) the image length L in an available time T whilst the print head (11) performs E thermal cycles to print the image, and the control means (30) manipulating the data so that the image is printed with the print head (11) omitting or repeat printing at least some of the columns of pixels so that the image has Z columns per unit length.

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the number of thermal cycles E performed by the print head in the time available T.

[0012] For example where the number of steps of movement of the print head A is greater than the number of thermal cycles E performed by the print head in the available time T to print the image the control means manipulates the data to omit columns of pixels from the image so that the resultant image has a reduced image linear resolution of Z. However where the number of steps of movement of the print head A is less than the number of thermal cycles E performed by the print head in the available time T to print the image the control means manipulates the data to repeat print at least some of the columns of pixels so that the resultant image may have a linear resolution of C.

[0013] In another embodiment the relative movement between the print head and the substrate is constant during the available time T to print the image. This may achieved by moving the print head relative to the substrate by a synchronous motor, or by moving the substrate past the print head.

[0014] In each case where the available time T to print the image is greater than that required by the print head to perform sufficient thermal cycles to print an image to linear resolution C, the control means may manipulate the data to cause columns of pixels to be repeat printed along the image length L so that Z is greater than C. Alternatively where the available time T to print the image is less than that required for the print head to perform C thermal cycles per unit length, the control means may manipulate the data to omit at least some of the columns of pixels so that a reduced resolution image is produced.

[0015] According to a second aspect of the invention we provide a printing apparatus comprising a thermal print head having a plurality of printing elements arranged in an array each of which may selectively be energised and de-energised under the control of a control means to transfer pixels of marking medium from a carrier onto a substrate or to activate pixels on a sensitive substrate, means to cause relative movement between the print head and substrate in a printing direction whilst the thermal print head performs thermal cycles to print an image of image length L, characterised in that the control means is adapted to control the apparatus to perform a method of printing according to the first aspect of the invention.

[0016] It is desirable to be able to print faster particularly where the printer is a so called over printer which may be positioned in a production or packaging line which operates more quickly than an over printer conventionally is able to print.

[0017] The invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is an illustrative view of one example of an apparatus which may be adapted to perform the method of the invention;

FIGURE 1a is an illustrative enlarged view of a print head of the apparatus of figure 1;

FIGURE 2 is a graphical illustration showing relative print head movement during print head thermal cycles.

[0018] Referring to figures 1 and 1a of the drawings there is shown a printing apparatus 10 comprising a thermal print head 11 having a plurality of printing elements 12 arranged generally in an array, i.e. in this example a linear array, across the print head 11. Typically there would be about 300 such elements 12 per inch, each of which may selectively be energised and de-energised during a printing operation under computer control, so that pixels of marking medium or ink, are transferred from a carrier e.g. a ribbon 14 onto a substrate 15 which in this example comprises a label, but may comprise a product or packaging for examples.

[0019] The ribbon 14 is stored on a storage spool 18, and passes along a ribbon path to a take-up spool 19 via idler rollers 20 and the like. The ribbon 14 passes through a printing station 21 where the print head 11 is located.

[0020] In the example of printing apparatus 10 shown, the substrate 15 is moved to the printing station 21, and is held stationary there whilst the print head 11 moves relative to the substrate 15 from a start position shown in full lines, to an end of print position shown in dotted lines whilst the printing elements 12 are selectively energised and de-energised as described below, to effect printing. There is provided a backing roller 22 which moves with the print head 11 to support the substrate, but in another example a platen may be provided.

[0021] At the end of a printing operation, the print head 11 is returned to the start position and fresh substrate 15 is moved to the printing station 21. Also, the ribbon 14 is wound on so that fresh ribbon is positioned at the printing station 21, so that another printing operation may be carried out. The print head 11 movement may include a movement towards the substrate 15 for printing, and a movement away from the substrate 15 after printing.

[0022] The ribbon 14 may be moved by a capstan drive arrangement (using a capstan wheel as shown in dotted lines at 25), the take-up spool 19 merely taking up the ribbon 14, or the take-up spool 19 may be driven e.g. by a stepper motor, to move the ribbon. Further alternatively a shuttle may be used to move the ribbon 14.

[0023] In another arrangement, the substrate 15 need not be stationary during printing but may be moved whilst the print head 11 may be stationary or moving. The ribbon 14 need not be stationary during printing, but may be moving.

[0024] Thus the apparatus may include any of the drive and/or ribbon saving features described and claimed in our previous patent applications WO96/32258, WO97/18089, WO97/36751 and

i.e. by causing a single relative stepping movement of the print head 11 in concert with at least one of the print head thermal cycles during a printing operation, and printing other parts of the image by causing relative stepping movement of the print head across two or more of the image columns.

[0041] Generally, where less time is available to print the image of length L than that required for the thermal print head 11 to be thermally cycled such as to produce an image to a resolution of RC, relative movement between the print head and the substrate is caused such that the print head relatively traverses the substrate the image length L in the available time T whilst the print head performs E thermal cycles to print the image, and the control means manipulates the data so that the image is printed with the print head omitting at least some of the columns of pixels so that the image has R rows per unit length and Z columns per unit length, where Z is less then C.

[0042] In another arrangement in which the print head 11 and substrate 15 undergo stepped relative movement during printing, the available time T to print the image of length L may be so great that if one thermal cycle was performed to print C columns of pixels, the efficiency of the high speed print head 11 may be impaired. Thus in figure 2d there is shown a print cycle in which C columns per unit length are printed along the image length, but the print head undergoes two thermal cycles for each step of movement. Because pixels are printed in the column positions as a result of the first of the two thermal cycles, the second thermal cycle does not result in the actual printing of further pixels, and so the resultant image resolution is RC notwithstanding that print head 11 may have performed greater than C thermal cycles.

[0043] Although the invention has been described in particular in relation to an arrangement in which the print head 11 undergoes stepped movement relative to the substrate 15 or the substrate 11 is stepped relative top the print head 11 during printing, the invention may be applied to an arrangement in which continuous relative movement takes place e.g. using a synchronous drive or the like. In this event the control means 30 will, depending on the time T available to print the image of length L, cause the print head 11 relatively to traverse the substrate 15 during printing so as relatively to move the print head 11 the length L while the print head 11 performs E thermal cycles, preferably being the maximum number of cycles the print head can perform in time T.

[0044] Thus again where less time is available for printing than is needed for printing to resolution RC, the control means 30 will manipulate the data provided thereto to print the image at a reduced resolution RZ by omitting some of the columns of pixels which according to the data provided, would otherwise enable the image to be printed to a resolution of RC.

[0045] If the thermal print head is thermally cycled more often that the number of columns C, extra columns of pixels will need to be printed, and conveniently the previous column of pixels may be repeat printed.

[0046] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A method of printing using a thermal print head (11) including a plurality of printing elements (12) arranged generally in an array each of which may selectively be energised and de-energised under the control of a control means (30) to transfer pixels of marking medium from a carrier (14) onto a substrate (15) or to activate pixels on a sensitive substrate, the method comprising providing to the control means (30) data dependent on the nature of the image to be printed which would enable the image having an image length L to be printed as a matrix of pixels at a linear resolution of C where C is the number of image columns per unit length in the direction of printing, characterised in that the method includes causing relative movement between the print head (11) and the substrate (15) such that the print head (11) relatively traverses the substrate (15) the image length L in an available time T whilst the print head (11) performs E thermal cycles to print the image, and the control means (30) manipulating the data so that the image is printed with the print head (11) omitting or repeat printing at least some of the columns of pixels so that the image has Z columns per unit length.

2. A method according to claim 1 characterised in that the number of columns of pixels printed per unit length Z is not equal to the number of columns C per unit length contained in the data provided to the control means (30).

3. A method according to claim 1 or claim 2 characterised in that relative movement between the print head (11) and the substrate (15) is performed in stepped manner, the control means (30) relatively stepping the print head A times to move the print head the image length L in the time available to print the image, where A is not equal to the number of thermal cycles E performed by the print head (11)in the time available T.

4. A method according to claim 3 characterised in that the number of steps of movement of the print head A is greater than the number of thermal cycles E

FIG 1

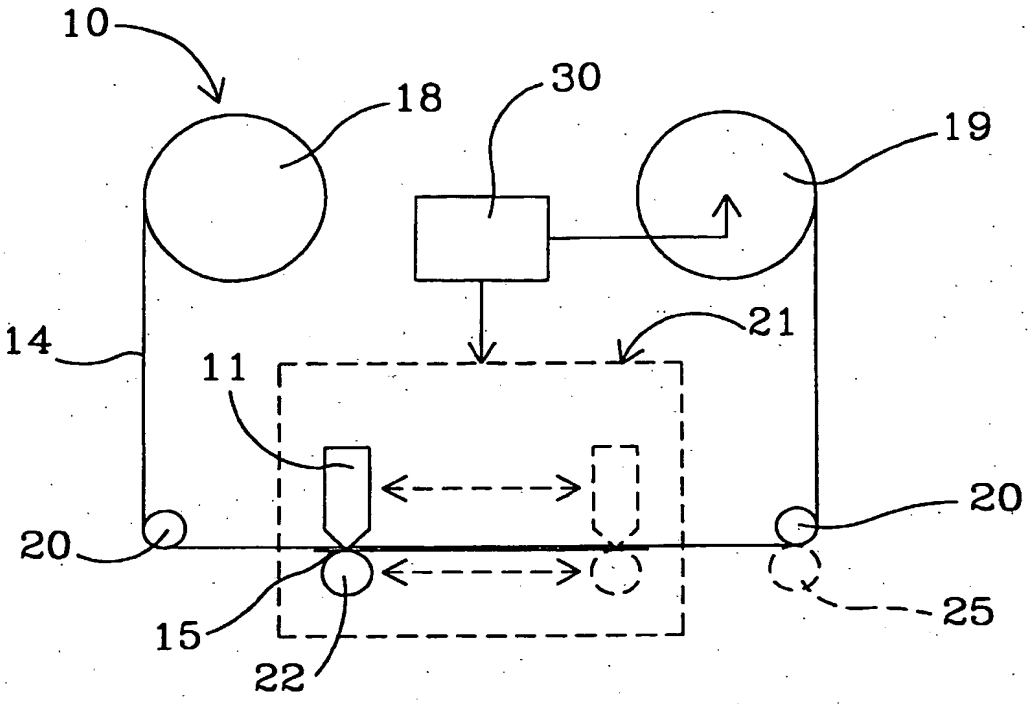


FIG 1a

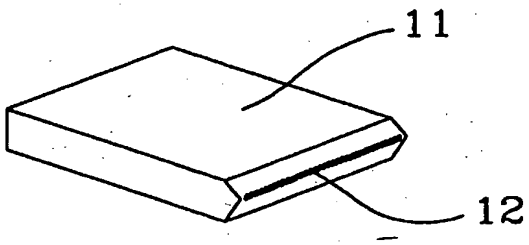
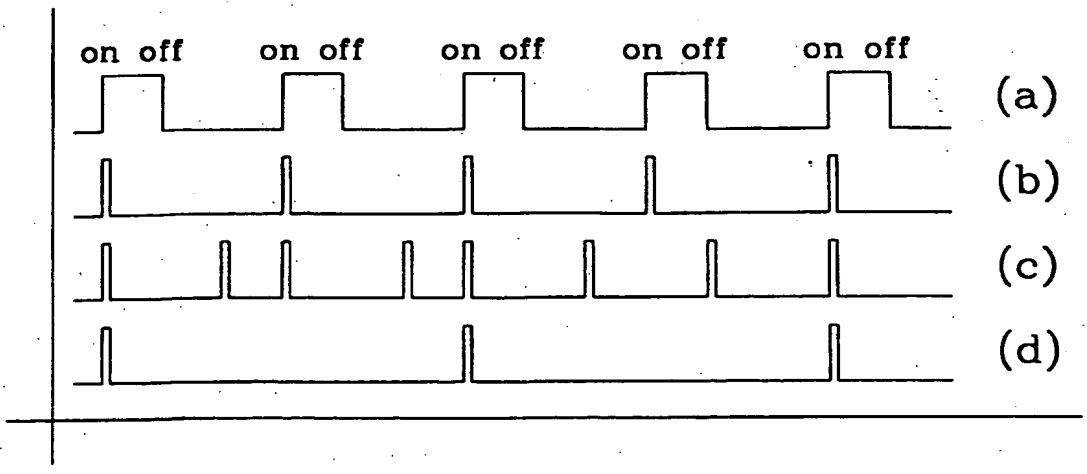


FIG 2



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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5675370 A	07-10-1997	US 6025861 A	15-02-2000
US 4216480 A	05-08-1980	AU 526048 B	16-12-1982
		AU 5210279 A	22-05-1980
		BR 7907325 A	15-07-1980
		CA 1115326 A	29-12-1981
		DE 2966871 D	10-05-1984
		EP 0013296 A	23-07-1980
		ES 485757 A	01-07-1980
		IT 1165367 B	22-04-1987
		JP 55067878 A	22-05-1980
JP 62170358 A	27-07-1987	NONE	
US 4586835 A	06-05-1986	AU 4143385 A	24-10-1985
		CA 1220082 A	07-04-1987
		DE 3572235 D	14-09-1989
		EP 0159895 A	30-10-1985
		ES 542408 D	16-09-1986
		ES 8700155 A	01-01-1987
		US 4703323 A	27-10-1987
		US 4712102 A	08-12-1987
		BR 8501840 A	17-12-1985
		JP 60225762 A	11-11-1985
		JP 60239252 A	28-11-1985
US 5149212 A	22-09-1992	JP 2861251 B	24-02-1999
		JP 4018376 A	22-01-1992
		DE 4110895 A	14-11-1991
		GB 2243808 A,B	13-11-1991
EP 0331033 A	06-09-1989	JP 1218851 A	01-09-1989
		JP 2008711 C	11-01-1996
		JP 7039191 B	01-05-1995

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